

CLAIMS

1        1. A luminous body with a prolonged fluorescence lifetime,  
2 characterized by comprising an activator and further at least  
3 one coactivator selected from the group consisting of lanthanum  
4 (La), cerium (Ce), praseodymium (Pr), neodymium (Nd), samarium  
5 (Sm), gadolinium (Gd), terbium (Tb), dysprosium (Dy), holmium  
6 (Ho), erbium (Er), thulium (Tm), ytterbium (Yb), lutetium (Lu),  
7 bismuth (Bi), tin (Sn), antimony (Sb) and analogues thereof as  
8 an additional luminescent center for enhancing the  
9 thermostability of luminous body.

1        2. The luminous body with a prolonged fluorescence  
2 lifetime according to claim 1, characterized in that said  
3 luminous body comprises silicate-germanate and is doped with  
4 europium to improve its thermostability, wherein the luminous  
5 body comprises an additional dopant and corresponds to the  
6 empirical formula:

7         $M'{}_aM''{}_b(Si_{1-z}Ge_z)_c(Al, Ga, In)_d(Sb, V, Nb, Ta)_eO_{(a+b+2c+3d/2+5e/2-}$   
8  $n/2)X_n:Eu_x, R_y$

9 wherein

10         $M'$  represents one or more elements selected from the  
11 group consisting of calcium (Ca), strontium (Sr), barium (Ba),  
12 and zinc (Zn);

13         $M''$  represents one or more elements selected from the  
14 group consisting of magnesium (Mg), cadmium (Cd), manganese  
15 (Mn), and beryllium (Be);

16         $R$  represents one or more elements selected from the group

17 consisting of La, Ce, Pr, Nd, Sm, Gd, Tb, Dy, Ho, Er, Tm, Yb,  
18 Lu, Bi, Sn, and Sb;

19 X represents an ion selected from the group consisting of  
20 fluorine (F), chlorine (Cl), and bromine (Br) to balance the  
21 charge;

22 and

23  $0.5 \leq a \leq 8$ ,

24  $0 \leq b \leq 5$ ,

25  $0 < c \leq 10$ ,

26  $0 \leq d \leq 2$ ,

27  $0 \leq e \leq 2$ ,

28  $0 \leq n \leq 4$ ,

29  $0 \leq x \leq 0.5$ ,

30  $0 \leq y \leq 0.5$ , and

31  $0 \leq z \leq 1$ .

1 3. The luminous body with a prolonged fluorescence  
2 lifetime according to claim 1, characterized in that said  
3 luminous body comprises aluminate-gallate and is doped with  
4 europium to improve its thermostability, wherein the luminous  
5 body comprises an additional dopant and corresponds to the  
6 empirical formula:

7  $M'_4(Al, Ga)_{14}(Si, Ge)_pO_{25+2p}:Eu_x, R_y$

8 wherein

9  $M'$  represents one or more elements selected from the  
10 group consisting of Sr, Ba, Ca, Mg, and Zn;

11 R represents one or more elements selected from the group  
12 consisting of La, Ce, Pr, Nd, Sm, Gd, Tb, Dy, Ho, Er, Tm, Yb,

13 Lu, Bi, Sn, and Sb;

14 and

15  $0 < p \leq 1$ , or

16 the empirical formula

17  $M''(Al, Ga)_2(Si, Ge)_pO_{4+2p}:Eu_x, R_y$

18 wherein

19  $M''$  represents one or more elements selected from the  
20 group consisting of Sr, Ba, Ca, Mg, and Zn;

21  $R$  represents one or more elements selected from the group  
22 consisting of La, Ce, Pr, Nd, Sm, Gd, Tb, Dy, Ho, Er, Tm, Yb,  
23 Lu, Bi, Sn, and Sb;

24 and

25  $0 < p \leq 1$ ,

26  $0 \leq x \leq 0.5$ , and

27  $0 \leq y \leq 0.5$ .

1 4. The luminous body with a prolonged fluorescence  
2 lifetime according to claim 1, characterized in that said  
3 luminous body comprises aluminate and is doped with europium to  
4 improve its thermostability, wherein the luminous body  
5 comprises an additional dopant and corresponds to the empirical  
6 formula:

7  $(M', M'', M''')M'''_2Al_{16}O_{27}:Eu_x, R_y$

8 wherein

9  $M'$  represents one or more elements selected from the  
10 group consisting of Ba, Sr, and Ca;

11  $M''$  represents one or more elements selected from the  
12 group consisting of lithium (Li), sodium (Na), potassium (K),

13 and rubidium (Rb);

14 M'' represents Dy;

15 M''' represents Mg or Mn;

16 R represents one or more elements selected from the group  
17 consisting of La, Ce, Pr, Nd, Sm, Gd, Tb, Ho, Er, Tm, Yb, Lu,  
18 Bi, Sn, and Sb;

19  $0 < x \leq 0.5$ , and

20  $0 \leq y \leq 0.5$ .

1 5. The luminous body with a prolonged fluorescence  
2 lifetime according to claim 1, characterized in that said  
3 luminous body comprises alkaline earth metal aluminate-gallate  
4 and is doped with europium to improve its thermostability,  
5 wherein the luminous body comprises an additional dopant and  
6 corresponds to the empirical formula:

7  $M'^{1-a}(Al, Ga)_b(Si, Ge)_cO_{1.5b+1+3c/2}:Eu_x, R_y$

8 wherein

9  $M'$  represents one or more elements selected from the  
10 group consisting of Ca, Sr, Ba, and Mg;

11 R represents one or more elements selected from the group  
12 consisting of La, Ce, Pr, Nd, Sm, Gd, Tb, Dy, Ho, Er, Tm, Yb,  
13 Lu, Bi, Sn, and Sb;

14 and

15  $0 \leq a \leq 1$ ,

16  $0 \leq b \leq 10$ ,

17  $0 \leq c \leq 8$ ,

18  $0 \leq x \leq 0.5$ , and

19  $0 \leq y \leq 0.5$ .

1       6. The luminous body with a prolonged fluorescence  
2 lifetime according to any one of claims 1 to 5, characterized  
3 in that said luminous body is in the form of a single type or a  
4 mixture of two or more types.

1       7. The luminous body with a prolonged fluorescence  
2 lifetime according to any one of claims 1 to 6, characterized  
3 in that said luminous body is used as a luminous layer in the  
4 preparation of LED.

1       8. The luminous body with a prolonged fluorescence  
2 lifetime according to any one of claims 1 to 7, characterized  
3 in that said luminous body is used in a layer which emits light  
4 ranging from colored light to white light in LED.

1       9. The luminous body with a prolonged fluorescence  
2 lifetime according to any one of claims 1 to 8, characterized  
3 in that said luminous body is used in LED which, upon switch-  
4 off of excitation energy of a luminous layer, causes a color  
5 change in emission of a radiation.

1       10. The luminous body with a prolonged fluorescence  
2 lifetime according to any one of claims 1 to 6, characterized  
3 in that said luminous body is in the form of a single type or a  
4 mixture of two or more types and is used in the preparation of  
5 a luminous layer of a compact energy saving lamp.

1        11. An optical device comprising a wavelength converting  
2 part comprising a luminous body which emits light upon  
3 excitation based on light emitted from an LED element,

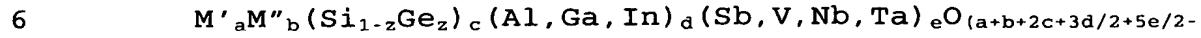
4        characterized in that said wavelength converting part  
5 comprises a luminous body comprising an activator and further  
6 at least one coactivator selected from the group consisting of  
7 lanthanum (La), cerium (Ce), praseodymium (Pr), neodymium (Nd),  
8 samarium (Sm), gadolinium (Gd), terbium (Tb), dysprosium (Dy),  
9 holmium (Ho), erbium (Er), thulium (Tm), ytterbium (Yb),  
10 lutetium (Lu), bismuth (Bi), tin (Sn), antimony (Sb) and  
11 analogues thereof as an additional luminescent center for  
12 enhancing the thermostability.

1        12. An optical device characterized by comprising:  
2            an LED element;  
3            a power feeding part for mounting said LED element  
4 thereon and feeding power to said LED element;  
5            a light transparent sealing part for sealing said LED  
6 element and said power feeding part integrally with each other;  
7 and  
8            a wavelength converting part for emitting light upon  
9 excitation based on light emitted from said LED element, said  
10 wavelength converting part comprising a luminous body  
11 comprising an activator and further at least one coactivator  
12 selected from the group consisting of lanthanum (La), cerium  
13 (Ce), praseodymium (Pr), neodymium (Nd), samarium (Sm),  
14 gadolinium (Gd), terbium (Tb), dysprosium (Dy), holmium (Ho),  
15 erbium (Er), thulium (Tm), ytterbium (Yb), lutetium (Lu),

16 bismuth (Bi), tin (Sn), antimony (Sb) and analogues thereof as  
17 an additional luminescent center for enhancing the  
18 thermostability.

1           13. An optical device characterized by comprising:  
2           an LED lamp;  
3           a light guiding part for guiding light emitted from said  
4 LED lamp;  
5           a wavelength converting part for emitting light upon  
6 excitation based on light guided through said light guiding  
7 part, said wavelength converting part comprising a luminous  
8 body comprising an activator and further at least one  
9 coactivator selected from the group consisting of lanthanum  
10 (La), cerium (Ce), praseodymium (Pr), neodymium (Nd), samarium  
11 (Sm), gadolinium (Gd), terbium (Tb), dysprosium (Dy), holmium  
12 (Ho), erbium (Er), thulium (Tm), ytterbium (Yb), lutetium (Lu),  
13 bismuth (Bi), tin (Sn), antimony (Sb) and analogues thereof as  
14 an additional luminescent center for enhancing the  
15 thermostability; and  
16           a lighting part for lighting based on light emitting  
17 through said wavelength converting part.

1           14. The optical device according to any one of claims 11  
2 to 13, characterized in that said wavelength converting part  
3 comprises a luminous body that comprises silicate-germanate and  
4 is doped with europium, wherein the luminous body comprises an  
5 additional dopant and corresponds to the empirical formula:



7  $n/2)X_n: Eu_x, R_y$

8 wherein

9  $M'$  represents one or more elements selected from the  
10 group consisting of calcium (Ca), strontium (Sr), barium (Ba),  
11 and zinc (Zn);

12  $M''$  represents one or more elements selected from the  
13 group consisting of magnesium (Mg), cadmium (Cd), manganese  
14 (Mn), and beryllium (Be);

15  $R$  represents one or more elements selected from the group  
16 consisting of La, Ce, Pr, Nd, Sm, Gd, Tb, Dy, Ho, Er, Tm, Yb,  
17 Lu, Bi, Sn, and Sb;

18  $X$  represents an ion selected from the group consisting of  
19 fluorine (F), chlorine (Cl), and bromine (Br) to balance the  
20 charge, and

21  $0.5 \leq a \leq 8$ ,

22  $0 \leq b \leq 5$ ,

23  $0 < c \leq 10$ ,

24  $0 \leq d \leq 2$ ,

25  $0 \leq e \leq 2$ ,

26  $0 \leq n \leq 4$ ,

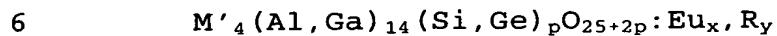
27  $0 \leq x \leq 0.5$ ,

28  $0 \leq y \leq 0.5$ , and

29  $0 \leq z \leq 1$ .

1 15. The optical device according to any one of claims 11  
2 to 13, characterized in that said wavelength converting part  
3 comprises a luminous body that comprises aluminate-gallate and  
4 is doped with europium, wherein the luminous body comprises an

5 additional dopant and corresponds to the empirical formula:



7 wherein

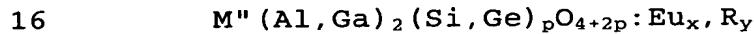
8  $M'$  represents one or more elements selected from the  
9 group consisting of Sr, Ba, Ca, Mg, and Zn;

10  $R$  represents one or more elements selected from the group  
11 consisting of La, Ce, Pr, Nd, Sm, Gd, Tb, Dy, Ho, Er, Tm, Yb,  
12 Lu, Bi, Sn, and Sb;

13 and

14  $0 < p \leq 1$ , or

15 the empirical formula



17 wherein

18  $M''$  represents one or more elements selected from the  
19 group consisting of Sr, Ba, Ca, Mg, and Zn;

20  $R$  represents one or more elements selected from the group  
21 consisting of La, Ce, Pr, Nd, Sm, Gd, Tb, Dy, Ho, Er, Tm, Yb,  
22 Lu, Bi, Sn, and Sb;

23 and

24  $0 < p \leq 1$ ,

25  $0 \leq x \leq 0.5$ , and

26  $0 \leq y \leq 0.5$ .

1 16. The optical device according to any one of claims 11  
2 to 13, characterized in that said wavelength converting part  
3 comprises a luminous body that comprises aluminate and is doped  
4 with europium, wherein the luminous body comprises an  
5 additional dopant and corresponds to the empirical formula:

6            $(M', M'', M''') M'''_2 Al_{16} O_{27} : Eu_x, R_y$

7   wherein

8           M' represents one or more elements selected from the  
9   group consisting of Ba, Sr, and Ca;

10          M'' represents one or more elements selected from the  
11   group consisting of lithium (Li), sodium (Na), potassium (K),  
12   and rubidium (Rb);

13          M''' represents Dy;

14          M''' represents Mg or Mn;

15          R represents one or more elements selected from the group  
16   consisting of La, Ce, Pr, Nd, Sm, Gd, Tb, Ho, Er, Tm, Yb, Lu,  
17   Bi, Sn, and Sb;

18           $0 < x \leq 0.5$ , and

19           $0 \leq y \leq 0.5$ .

1           17. The optical device according to any one of claims 11  
2   to 13, characterized in that said wavelength converting part  
3   comprises a luminous body that comprises alkaline earth metal  
4   aluminate-gallate and is doped with europium, wherein the  
5   luminous body comprises an additional dopant and corresponds to  
6   the empirical formula:

7            $M'^{1-a} (Al, Ga)_b (Si, Ge)_c O_{1.5b+1+3c/2} : Eu_x, R_y$

8   wherein

9          M' represents one or more elements selected from the  
10   group consisting of Ca, Sr, Ba, and Mg;

11          R represents one or more elements selected from the group  
12   consisting of La, Ce, Pr, Nd, Sm, Gd, Tb, Dy, Ho, Er, Tm, Yb,  
13   Lu, Bi, Sn, and Sb;

14 and

15  $0 \leq a \leq 1$ ,  
16  $0 \leq b \leq 10$ ,  
17  $0 \leq c \leq 8$ ,  
18  $0 \leq x \leq 0.5$ , and  
19  $0 \leq y \leq 0.5$ .

1 18. The optical device according to claim 12,  
2 characterized in that said wavelength converting part is  
3 included in said light transparent sealing resin for sealing  
4 said LED element.

1 19. The optical device according to claim 12,  
2 characterized in that said luminous body is a thin-film  
3 luminous body layer that is sealed with said light transparent  
4 glass.

1 20. The optical device according to claim 19,  
2 characterized in that said luminous body layer is planar.  
3

1 21. The optical device according to claim 12,  
2 characterized in that said wavelength converting part is  
3 provided on a surface of the sealing resin having an optical  
4 shape that radiates light emitted from said LED element in a  
5 desired lighting area.

1 22. The optical device according to any one of claims 11

2 to 13, characterized in that said wavelength converting part is  
3 excited upon exposure to blue light and/or ultraviolet light  
4 with wavelengths ranging from 300 nm to 500 nm.